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ABSTRACT

This course entitled "Botany" is one of a series of instructional guides prepared by teachers for the Sahuarita High School (Arizona) Career Curriculum Project. It consists of five units of study, and 20 behavioral objectives relating to these units are stated. The topics covered include the classification of plants, morphology, plant reproduction, seeds, and heredity. The units provide a statement of the rationale, objectives, sources of information, and a series of student activities. For related units in this series see SE 016 635 - SE 016 644. (JR)

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# SAHUARITA HIGH SCHOOL

# CAREER

# CURRICULUM

# PROJECT

COURSE TITLE: BOTANY

UNIT TITLE: PLANTS

BY

ROBERT ESSER

SE 016 641

OBJECTIVES

1. Who was Conlus Linneas?
2. Distinguish vascular plants from non-vascular plants.
   a. Identify 10 careers in which a person would work with plants.
3. Identify seven phylums of plants.
4. What is binomial nomanclature (2 named system)?
5. Describe the function of leaves, stems, and roots in the total plant.
6. Name the parts of leaves, stems, roots, and flowers.
7. Describe how a plant grows.
8. Youw ill be able to distinguish between sexual and asexual reproduction.
9. You will be able to list from memory the steps in meiosis.
10. You will be able to name the reproductive structures of an angio sperm either orally or written.
11. You will be able to identify terms.
12. Plant some common seeds from desert plants, study their growth and keep records of at least three plants.
13. Describe a seed and its parts.
14. Describe Mendel's theory of heredity.
15. Construct a model showing what happens to genes and chromosomes during meiosis.
16. Construct a model of feritlization showing what happens in the recombination of genes on chromosomes.
17. Describe how mutation may occur.
18. Be able to use the principles of probability in predicting offspring types (phenotypes and genotypes) of known parents.
19. Using the principles of probability and knowing the phenotype and genotype of offspring be able to tell the genotype of parents.
20. Have an understanding of skills needed to enter into special areas.

UNIT I

PLANTS

PART I - CLASSIFICATION

Rationale

Working with plants has been a major occupation of man for years and also for recreation. It is a principle source of food for man and all other animals either directly or indirectly. Here is a list of related career areas:

Florist

Gardener

Logger

Nurseryman

Feel Lot Manager

Forest Ranger

Animal Production
Beef, sheep, hogs, etc.

Dairyman

Farmer

Landscaping

Fish and Game Ranger

Horticulturist

Plus all the related career areas of Foresting, Processing, Distributing, etc.

Objectives

1. Who was Conlus Linneas?

2. Distinguish vascular plants from non-vascular plants.

   a. Identify 10 careers in which a person would work with plants.

   Identify seven phylums of plants.

4. What is binomial nomanclature (2 named system)?

INFORMATION SOURCE

Cactus mesquite, palo verde, lettuce, oranges, and carrots--these are some of the plants you already know or at least have

heard of. Chances are that most of the plants you know are in the tracheophyta (vascular plants). This is one of the seven phylums you will need to identify.

This group is the most important economically and includes grains (corn, wheat, barley, rice, etc.), which are principle foods for us and other animals, vegetables, trees, etc. There are other phylums with which you are less familiar:

1. Chlorophyta or Green Algae
2. Chrysophyta or Golden Algae
3. Phaeophyta or Brown Algae
4. Rhodophyta or Red Algae
5. Mycophyta or Fungi (here the molds and mushrooms belong)
6. Bryophyta or mosses and their relatives, liverworts and hornworts
7. Tracheophytes (Vascular plants)

You need not memorize these terms but remember that the terms identify and distinguish are the action words. If you do not know what they mean, check with your past list or check with me.

The vascular plants have developed means for transporting materials (water and food stuffs) in themselves. This is done by a continous system of tubes or poles (vascular system) extending through the roots, stems, and leaves. By means of this system, water and substances disolved in it are moved from one part to another in the plant. A good conducting system is necessary for land plants to grown tall, like the large trees. It is also necessary for the roots to get water minerals for the smaller vascular plants like bermuda grass.

The non-vascular plants are not so conspicuous and you probably do not know many of these though they are important as food for the qater living animals. The tracheophytes are not very important in the world of water. Though some non-vascular

plants live outside the water, most live in a very moist environment, along streams, etc.

Activities

1. Review appendix, pages 784-790 in your text.

2. Filmstrips on plants E.B.F.

Titles: 1. How Plants are Classified
2. Ferns and Fern Allies
3. Bryophytes, Algae

3. Study prepared slides under the microscope, also, other examples of plants in the classroom.

4. Read Chapter five.

5. Write a brief description of the list below.

1. taxonomy
2. Conlus Lineas
3. Tracheophyta
4. Chlorophyta
5. Bryophyta
6. Mycophyta
7. Rhodophyta
8. Phaeophyta
9. Gymnosperms
10. Angiosperm.

d

6. When you know this material see the teacher for competency.

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CURRICULUM

PROJECT

COURSE TITLE: BOTANY

UNIT II

BY

ROBERT ESSER

BOTANY

UNIT II

PART II - MORPHOLOGY

Objectives

5. Describe the function of leaves, stems, and roots in the total plant.

6. Name the parts of leaves, stems, roots, and flowers.

7. Describe how a plant grows.

Information Sources

The plants in general are capable of producing their own food from raw materials and the energy they get from their environment. The leaf's main function is to produce food: this is done by a process called photosynthesis which we will study in more detail later. The stem's main job is getting the leaves placed so they will receive sunlight (energy) in order for them to produce food, also, to transport water and minerals to the leaves and dissolved food to other parts of the plant. The roots anchor the plant in the ground and collect water and minerals for the rest of the plant. The flower, which is the reproductive part of the plant, will be discussed under the topic of Reproduction later.

A plant grows from cells which are dividing. These are usually located at the tips of the stems and roots, also, where the buds are at. The stem of a tree grows in diameter by a ring of cells just under the outer vark of the tree. The parts of the leaves, stems, and roots are listed below.

Root

1. Root tip
2. Root hairs
3. Vascular cylinder (endodermis pholem pericycle)
   (cambium xylem )

Stem
1. Bark
2. Phloem
3. Cambium
4. Xylem
5. Pith

Leaves
1. Waxy cutic
2. Upper epicermis
3. Palisade layer
4. Spongy layer } mesophyll
5. Vein
6. Stomate
7. Guard cells
8. Lower epidermis

Activities:

1. Read Chapter 18, page 443.

2. Lab 13.1

3. Lab 13.2

4. Lab 13.3

5. Study models in class.

6. Take competency.

7. Questions 2, , 5, 6, 8, 9, 13, 14, 8, page 474 in Green version.

8. Problems 2, 5, page 475.

9. Read pages 426 to 437 and answer questions 20, 21, 22, 23, on photosynthesis.

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CURRICULUM

PROJECT

COURSE TITLE: BOTANY

COURSE TITLE: PLANT REPRODUCTION

BY

ROBERT ESSER

# BOTANY III

## PLANT REPRODUCTION

To understand the sexual reproduction of a plant or an animal you will first have to have a basic understanding of the process of meiosis.

In sexual reproduction two gametes come together to form the new individual. If each gamete, or sex cell, had a full compliment of chromosomes the new individual would have two times the normal number of chromosomes. After only a few matings the chromosom number could be very high. Therefore, each gamete has only half the normal (2n) number of chromosomes (or n). This is why meiosis is known also as reduction division.

In this unit you will also study the life cycle of an angio sperm (flowering plant). You will also take a brief look into some of the other types of reproduction that occur within the plant kingdom.

Objectives

1. You will be able to distinguish between sexual and asexual reproduction.
2. You will be able to list from memory the steops in meiosis.
3. You will be able to name the reproductive structures of an angio sperm either orally or sritten.
4. You will be able to identify the terms

a. asexual reproduction
b. gamete
c. alternation of generation
d. sexual reproduction
e. sprophyte
f. gametophyte
g. zygote
h. fruit
i. egg
j. sperm

Activities

1. Read pages 578-582, answering questions 1-5. REad pages 584-589, answering questions 6-10 in BSCS.

2. Do investigation 16.2.

3. Read pages 591-599 in BSCS.

4. Study the p'ctu of the flower generalized and learn reproductive structures of an angio sperm.

5. Look at the film strip Fruit , their parts and functions (sound).

6. Learn these terms and write their meaning.

annual
biennial
perennial
ovary
ovul
sepal
petal
pistol
stigma
style
stamen
anther
egg cell
male cell
pollen
self pollination
cross pollination
selective breeding
fertilization
reproduction

Fruits therir growth and classification:

fruit
ovary
ovule
recepticle
fertilization
pollen
cross pollinat on
grafting

Dry fruits:

Pomes
drups
berries
modified berries
multiple fruits
bonarra

Dry fruits:

grain palms legumes
nuts
capsules
winged fruits

The following material was deleted: Wards' Natural Science Establishment's "Flower - Generalized" (Picture).

# BOTONY COMPETENCY #1

I. Write a short composition on plant reproduction using flowering parts and the terms asexual, sexual and alternation of generation.

II. Match the best definition to each term.

1. _____ a sex cell.
2. _____ a matured ovary of an angio sperm.
3. _____ a non-motile female gamete.
4. _____ the union of 2 gametes.
5. _____ reproductive cycle involving both sexually and asexual reproduction.
6. _____ vegatative reproduction
7. _____ a motile male gamete.
8. _____ plant produces gametes.
9. _____ reproduction involving two types of gametes.
10. _____ plant which produces spores.
11. _____ fertilized egg.

a. asexual reproduction
b. gamete
c. alternation of generation
d. sexual reproduction
e. sporophyte
f. gametophyte
g. zygote
h. fruit
i. egg
j. sperm
k. fertilization

SAHUARITA HIGH SCHOOL

CAREER

CURRICULUM

PROJECT

COURSE TITLE: BOTANY

UNIT TITLE: PLANTS UNIT IV

BY

ROBERT ESSER

# BOTONY

## Plants Unit IV

Seeds

Objectives:

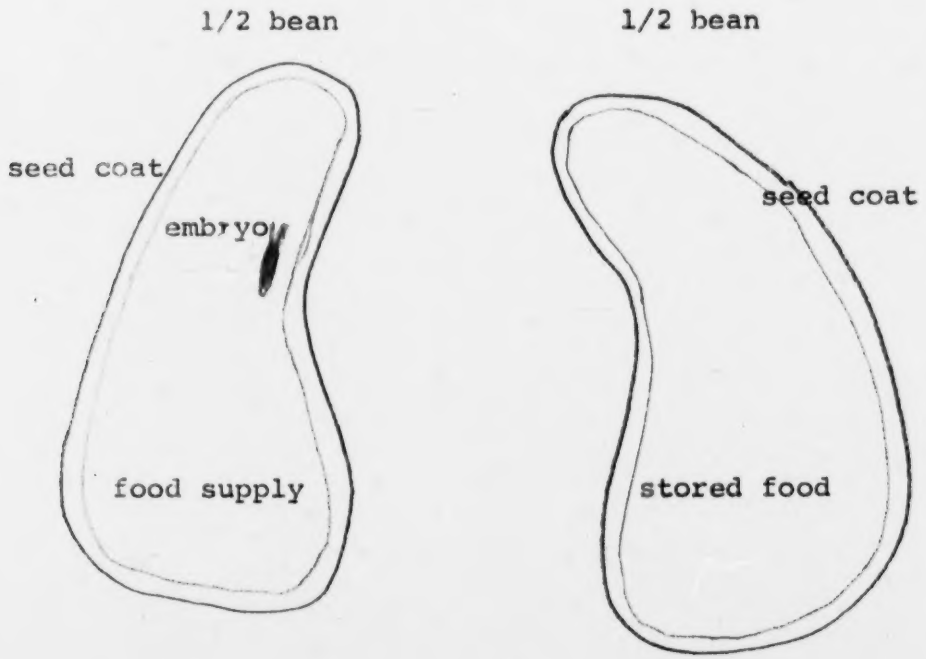
31. Plant some common seeds from desert plants, study their growth and keep records of at least three plants.

32. Describe a seed and its parts.

Information Source:

The reason for planting a group of sseds is for you to understand the needs of plants, also for you to understand how a plant functions in the world it lives.

A seed is made up of three main parts: First, and most important, is the living embryo; Second, the food on which the embryo lives: and Third, a protective cover to hold these together (seed coat).



Activities:

1. Get a bean seed from the instructor, disect it, and find the embryo, seed coat and food supply.

2. Study other seeds you have collected and see if you can find these parts.

3. Take competency.

SAHUARITA HIGH SCHOOL

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PROJECT

COURSE TITLE: BOTANY

UNIT V

BY

ROBERT ESSER

BOTONY

Unit V

## Heredity

### Rationale

Heredity is what determines what you are after reproduction, which was studied in the last unit.

Gregor Mendel developed a useful theory of heredity which we still use today with some added theories. The proof of a theory is its useability in science to continue to account for new evidence that comes out of scientific research and the ability to predict results. Mendel's theory has stood up well to this test. A theory as such, is never actually proven in the deepest sense of the word and this is an area not for science anyway.

Mendel's experiments and their results led him to develop his theory which is based on these experiments: that heredity is determined by particles (we call genes), and that these genes are in pairs in the individual. Each pair of genes is for a certain characteristic in an individual but may be for a different expression of that characteristic. The genes for this defferent expression of the characteristic are called alleles and there may be one more than two alleles for each expression; but normally each individual will have only two genes from each parent. These alleles may be carried in two ways: (a) both being identical, (pure for the characteristic), and (b) each may be different (hybred for the characteristic if it shows the trait.

The idea of dominance, where one of the alleles will show its characteristics (as tallness in peas), even though it has the other allele (for shortness in peas). The pea plant will look just as though it had identical alleles (pure for trait), so you will not be able to tell by looking at the individual must be pure for the characteristic if it shows the trait.

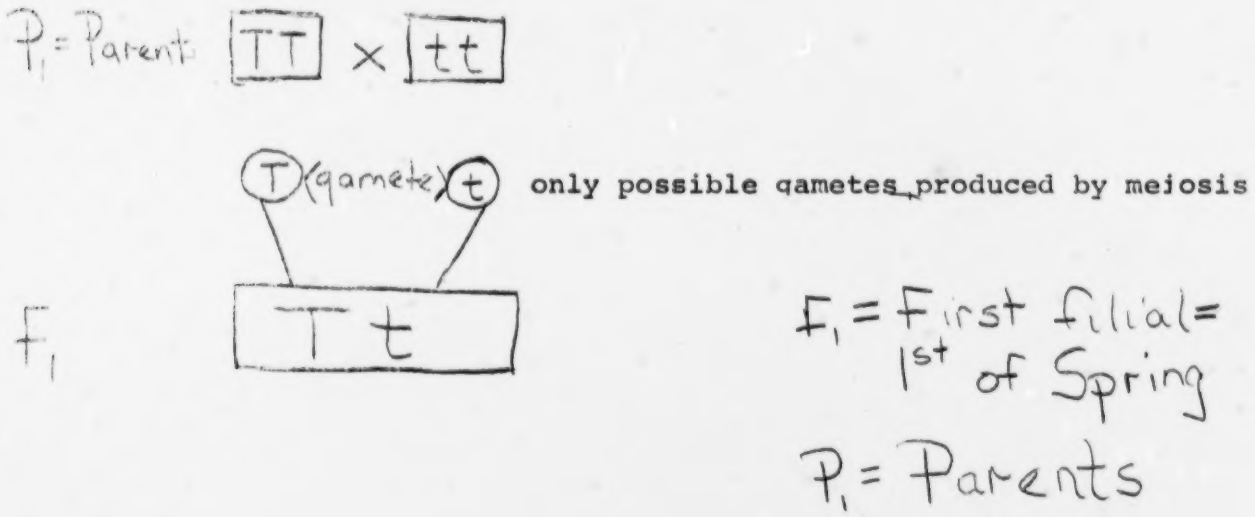
There is also the case where one allele does not dominate another and both alleles show hhemselves in an individual, such as red four-o' clock (pure) and white four-o' clock (pure for trait), If they are crossed, their hybred offspring would be pink. A case where both alleles show themselves together is called incomplete dominance.

This idea of genes, recessiveness, dominance or incomplete dominance, can be constructed in a model. This model will also give the probability of the offspring having certain traits.

We will use letters to indicate genes on chromosomes such as (T) for tallness, if there is an allel which is recessive for

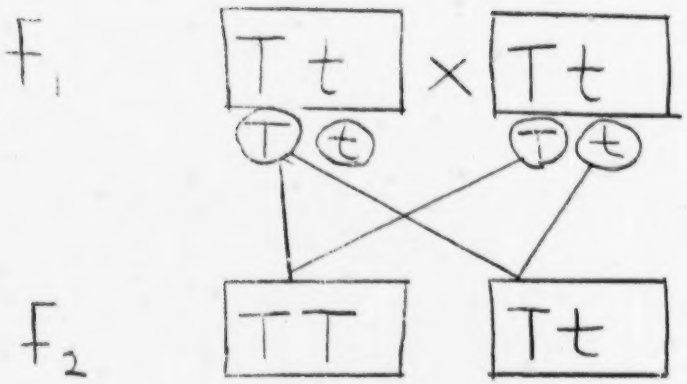
shortness as there is in pea plants we will use the lower case of the letter to indicate this gene (t) for shortness. The capital (T) as shown before would indicate the dominant gene for tallness.

The results of a cross of a pure tall pea plant (Homozygous) parent indicated by , showing the paired gene on the chromosomes with a pure short pea plant indicated by . Remember T indicated the dominant gene for tallness in pea plants, also that t is the recessive trait for shortness.

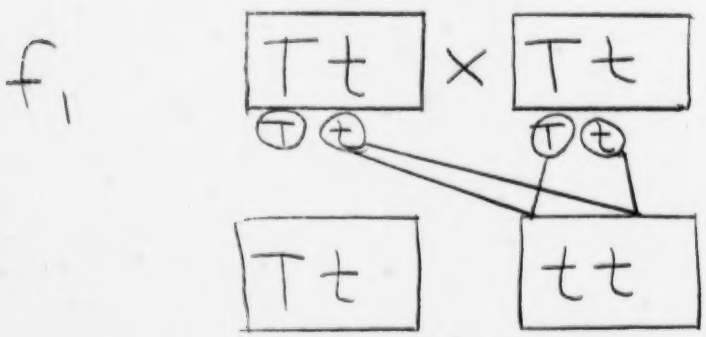



Taking the $F_1$ generation which are all hybreds (heterozygous), which means having each gene of the pair different (alleles), one for shortness (t) and the other for tallness (T). Since tallness is dominant all the offspring of this cross will look like the tall parent (phenotype), even though its Genotype (the kind of gene it has) one (T) from the tall parent and (t) rom the short parent.

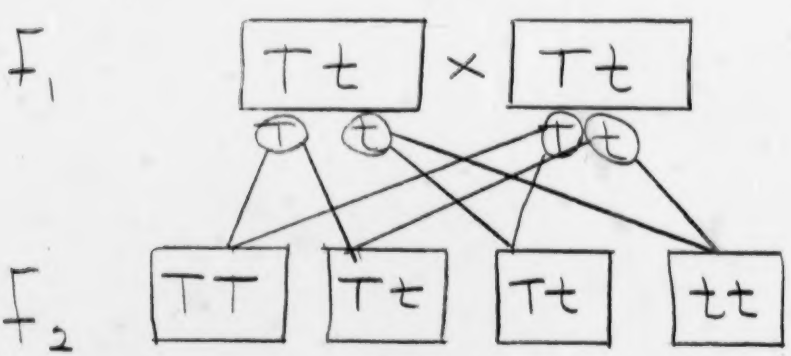
C ossing the $F_1$ generation with itself means the two parent has the alleles for tallness and shortness. So the probability is that 1/2 of the gametes (eggs or sperms) will carry the gene for tallness and the other 1/2 of the gametes will carry the gene for shortness. Now each gamete is carrying many other genes besides the ones we are concerned with. These are for all the other traits an individual organism has but we will concern our studies to the known genes, so we only show these:



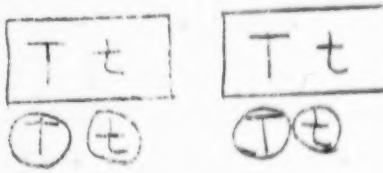

As you see the probability is that the gamete of one parent joining with or the of the other parent is 50:50 (1/2:1/2), the same is true of the short gametes.

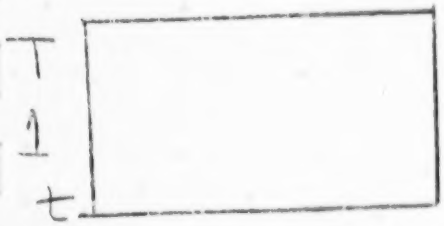


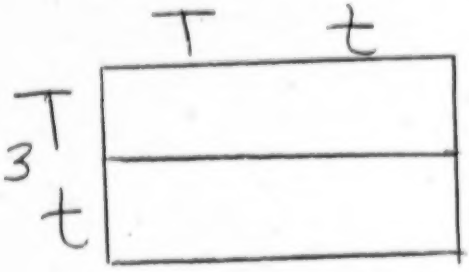

Giving us a total of 4 offspring.

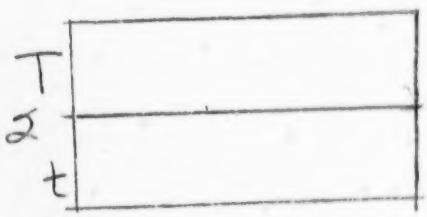


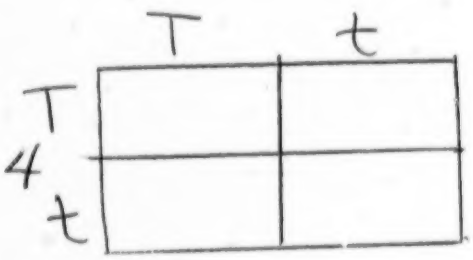
This method of drawing lines from the gametes to all the possible combinations works well with only 1 pair of genes. But if we are to work with more than one pair, another method is much easier. It is one taht can be used for these examples also: first, you take the gamete from one parent and place them on the side of a square; second, draw a line between them making the square in two parts; third, take the gametes from the other parent and place them on top (equal spacing); fourth, draw a line betwen them; and fifth, in each box thus formed place the letter representing a chromosome with a gene on it from the top and the side to part two letters in each box.

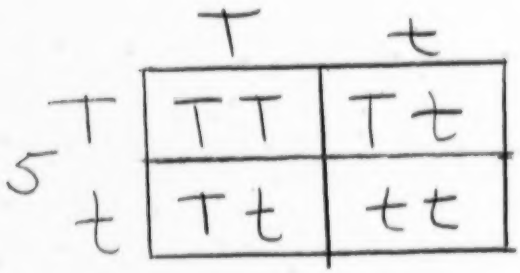


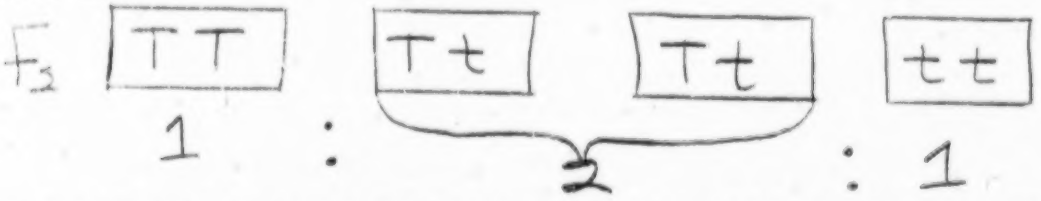



These are the same possibilities as the line method gave us. Or pure tall [TT], two hybrid [Tt] [Tt], and one pure short [tt]. This phenotype (what the grown individual would look like) ratio is 3 tall and 1 short on an average, because the pure [TT] and the two hybrid [Tt] would all look alike and be tall.

Only pure recessive for shortness [tt] could appear short in the pea plants.

Now the genotype ratio which is the gene the individual has will be:




This ratio of 3:1, phenotype two, 1:2:1 genotype are the basic ratios used to determine offspring and parent for the offspring. This will be discussed in lecture and is also developed in detail in your textbook.

Genes are found on chromosomes and are made up of a chemical substance called D.N.A. for short. This molecule is very stable and does not change very often; but if it does, this change in the genes chemistry is called a gene mutation. It may cause a change in the traits of an individual. There are other kinds of mutations which may not be a chemical change, this is a mechanical change in the arrangement of genes on a chromosome or the loss of some genes by losing parts of a chromosome. There is also the possibility that paired chromosomes will not separate during meiosis (called nondisjunction) thus if fertilization occurs after this, an individual may have 3 chromosomes or more for similar traits causing a change in their expression.

Other men and women have contributed to Mendel's theories, the ones mentioned in your text have all contributed to our present study of genetics. They are: T. H. morgan - sex chromosomes work with Drosophilia fruit flies; W. S. Suttons - chromosome theory; C. B. Bridges - Nondisjunction.

In many areas of employment the employee needs to have a background of genetics. Materials for these are in the magazine pamphlet rack. The courses involved are in: (1) Fish and Wildlife Management, (2) Forestry, (3) Timber, (4) Crop and Animal Production, (5) Horticulture Products, (6) Seed Production. There are other areas also. If you find materials in other areas, please bring them in so they may be added to our materials in class.

The areas of employment and skills needed in these fields are varied and many. Some of the jobs need a college degree, others do not need a high school diploma. But all of them need a good attitude and willingness to do a good job. For these are important to be successful in any employment.

II. Objectives

53. Describe Mendel's theory of heredity.

54. Construct a model showing what happens to genes and chromosomes during meiosis.

55. Construct a model of fertilization showing what happens in the recombination of genes on chromosomes.

56. Describe how mutation may occur.

57. Be able to use the principles of probability in predicting offspring types (phenotypes and genotypes) of known parents.

58. Using the principles of probability and knowing the phenotype and genotype of offspring be able to tell the genotype of parents.

59. Have an understanding of skills needed to enter into:

Career Cluster: Agriculture - Business and National Resources

Special Areas: Timber, Forestry, Fish and Wildlife, Crop and Animal Production, Horticultural Products.

HEREDITY

SELF-TEST

1. What is heredity?
2. Define these terms:
   a. dominance
   b. recessive
   c. pure
   d. hybred
   e. incomplete dominance
   f. mutation
   g. chromosome
   h. gene
   i. gamete
   j. haploid
   k. diploid
   l. fertilization
3. Sh · a model and ratio of the cross of the following:

   T = Tall pea vine

   t = Short pea vine

P TT × tt

O O gametes

F.

   W = Wrinkled skin on pea

   w = Smooth skin on pea

P. Ww × Ww

F.

4. Show fertilization of these gametes:

5. What were the parent genotypes and phenotypes of these offspring:

6. Describe 3 ways in which mutation can occur.

7. Give 2 examples of mutation that you know about.

IV. INFORMATION SOURCES

1. Chapter 17 Green Version
2. Chapter 10 and 11, Living Things
3. Charts in front of room
4. Phonograph record; "Gene the Core of Our Being"
5. Filmstrip set: Introducing Genetics
6. Filmstrip set: D.N.A. - The Key to All Life
7. Motion Picture: "D.N.A. Molecule of Heredity"
8. Motion Picture: "Genetics Improving Plants and Animals"
9. Readings in the library:
   a. Chromosome's Disease, Scientific American, Reprint 1961, November.
   b. Genetic is Easy, by Goldstein, P.
   c. Human Genetics, by Englewood Cliffs.
   d. Bloodtype filmstrip (Sound).

V. ACTIVITIES

Green Version

| | | |
|---|---|---|
| Read pages: | 624-628 | Do guide question 1. |
| | 629-636 | Do guide question 2-6. |
| | 636-641 | Do guide questions 7-8. |
| | 641-647 | Do guide questions 9-12. |
| | 647-652 | Do guide questions 13-16. |
| | 653-658 | Do guide questions 17-18. |
| | 659-664 | Do guide questions 19-23 |
| | 664-669 | Do guide questions 24-25. |

VI. Do problems 1,2,3,5,6, Pages 670-671.

Investigation 17.1 Probability pages 629-630.

17.3 Seedling phenotypes (blood type) 651-652.

17.4 Human inheritance 656-658.

VII. Write Definations for the following terms.

linkage — crossing over

mutation — sex determination

leathal gene

VIII. Final Evaluation: Ask teacher for it.

IX Quest: Do a research paper on heredity or develop a lab that involves genetics. Ideas on research shelf.